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SHORTER ARTICLES AND DISCUSSION

NOTES ON THE NEMATODE GENUS CAMALLANUS

Recently a paper by Dr. G. A. MacCallum entitled "Notes on the Genus *Camallanus* and Other Nematodes from Various Hosts" has come to my attention. It is dated July, 1918, and appeared in *Zoopathologica.* I have carefully investigated the date of the paper and find that although it appeared in the July, 1918, number of *Zoopathologica* it was not received at the Library of the Bureau of Animal Industry until August, 1919, and at that time neither the John Crerar, the National Museum Library, the Library of Congress, nor the New York Public Library had received their copies. The Secretary of the New York Zoological Society stated that the edition was sent to Dr. MacCallum, October 14, 1918, and as nearly as I can learn was not mailed out until August, 1919. In a personal letter Dr. MacCallum stated that the paper was "partly issued on July 1, 1918." My paper on *Camallanus americanus* was mailed out on August 13, 1919, and since I can not obtain a definite statement as to the date on which MacCallum's paper was mailed, it is impossible for me to state which paper actually has priority of date. MacCallum's paper was unknown to me at the time my monograph on *C. americanus* (1919) was published; hence it seems that I should discuss the form described by MacCallum, since some of my concepts concerning the genus and its species do not conform with his observations.

In the first place, attention should be called to the fact that MacCallum was undoubtedly misled by the brevity of a preliminary paper by Ward and Magath (1917) into thinking that we believed the two species described were the first from America, as MacCallum asserts. We were well aware of the fact that Leidy (1851) had found the genus, under another name, many years before and had named several species from America. At the time we had many records of it and a great deal of material and, in fact, considered it a common parasite. I have gone over the paper quite carefully and can not see why MacCallum should say that the "general tenor" of our paper implies that the worm is rare.

MacCallum apparently places the genus *Camallanus* in a subfamily within the family Strongylidæ; I am sorry to disagree with him, however, on fundamentals. He bases his argument on four statements:

1. These worms live in the same organ. However, so do many other worms, trematodes, cestodes, and so forth.

2. They have identical habits and attach themselves to the mucous membrane in the same manner. The true situation is clearly set forth in Looss's (1905) monograph on the hookworm and in my paper on *Camallanus americanus*. Ward (1917) has called attention to the fundamental structural difference in the buccal apparatus of the Strongylidæ and I have pointed out the various methods of attachment to the mucous membrane. The members of the genus *Camallanus* are blood suckers; this may be true of some strongyles, but not of the hookworm. Looss has shown clearly that it is not a blood sucker and gets blood only incidentally as it feeds on the mucous membrane of the host.

3. The muscular pharynx or upper part of the esophagus is essentially the same in both types. This part of the esophagus is the same in all the Myosyringata.

4. The structure of their mouths MacCallum believes to be essentially the same. Ward and I have called attention to the basic fact that the mouths of the strongyles are built up on the circular plan, that they hold fast by suction and then shave off the mucous membrane with additional structures, such as internal cutting plates of the hookworms. In the genus *Camallanus* the mouth is built up on a lateral plan. The valves are in truth jaws and bite; suction is secondary and is produced, as in all Myosyringata, by the action of the esophagus.

It would lead me too far astray to take up all the differences between the families Camallanidæ and Strongylidæ because they even belong in different superfamilies, but I may point out the fact that the former are viviparous forms, while the latter are oviparous, that the Camallanidæ have but one single ovary and the males genital alæ, while in the other family the females have two ovaries and the males have bursæ. These are such important facts in the structure of nematodes that were there no other points of difference, such as the double character of the esophagus in the Camallanidæ, the heavier character of the spicula, and the lack of gubernacula, that they could not be considered in the same subdivision.

I must call the reader's attention to the following points in MacCallum's brief description of the genus *Camallanus:*

1. The length of the worms as given does not embrace enough variation, nor does the recorded width. Worms within this genus have been recorded nearly twice the greatest dimensions which he gives, and mature females have been found much smaller than those which he describes.

2. The ridges in the valves are not always "six main ribs on each side of the central line."

3. My experience is that the worms are dislocated from the mucous membrane with difficulty and that often they are pulled in two or a plug pulled out of the intestine before they can be loosened.

4. I presume that "the bar of chitin across the anterior ends of the median four" ridges is the structure that I have called the anterior wing and its purpose is the attachment of the giant buccal muscles primarily and not for "stiffening them" only, if at all.

5. Certainly not all the males have "three pairs of post-anal papillæ, and one pair of pre-anal." In fact, I am sure that most if not all members of this genus have seven pairs of pre-anal papillæ and five pairs of post-anals, with two para-anal pairs.

6. "The semicircular flap" does not act like a bursa. The action of this structure, correctly called "alæ" has been explained by Magath (1919) and its difference from the action of a true bursa shown.

With regard to the new species; MacCallum identified *C. oxycephalus* from a Mississippi alligator. It is impossible to know whether or not he really had a worm belonging to this species. It would be interesting to know that a species harbored in fishes could live in an alligator. If, as he says, the "general description" from the genus will answer for this species he can not be certain that he had *C. oxycephalus* because there is nothing in his general description that is specific for this worm or any other species.

MacCallum's descriptions of *C. scabræ* and *C. troosti* are so indefinite and meager that either species can not be identified positively from the descriptions and figures. He gives very few measurements and the magnification of the figures is not stated. I had hoped to be able to compare his species with *C. americanus* but I can find no definite data in his paper on which to base the comparison.

The description of *C. chelydræ* is passed over with the statement that "there is no appreciable difference between these and the general description" of the genus which MacCallum states also fits *C. oxycephalus.* The status of this new species seems to me to be doubtful.

MacCallum's basis for describing *C. floridianæ* as new seems to lie in the fact that

> the rods are placed on two levels, one set of four being in front and the other set of four placed behind, and diagonally across the first. Whether this condition is only an exemplification of the way in which they act normally by a sawing motion, I do not know, but this would be reasonable. They may act like a pair of hair clippers and were caught in this position when death took place.

The action which MacCallum assumes is probably not the method of action of these jaws. Since I have previously pointed out the method of action of the jaws, no more needs to be said here on the subject. The criss-cross arrangement of the ridges in the mouth apparatus is well explained on the basis of MacCallum's drawing, which shows that the head of the worm was tilted; I have often seen the same condition in poor mounts of other members of this genus when the heads are twisted a trifle. The appearance is purely an artifact. MacCallum's next point is that this worm has only two parts of the trident present, or that it has, in other words, a bident. The figure does not bear out this assertion; two typical *tridents* are shown, each with three prongs. MacCallum states that the males have six pairs of pre-anal papillæ and three post-anal pairs.

The description of *C. elegans* is quite brief. The author could not determine whether or not the males have one or two spicula, and because the male tail is "not so complete and pretentious as in *C. floridianæ*" he believes that the worms deserve a new name.

In *C. ptychozcondis* the only feature MacCallum noted that seems at all distinctive is the fact that the intestine follows immediately after the muscular esophagus. If this is the case this worm is not a member of the genus *Camallanus.* The anus is on the left of the worm described. If the observation is correct it is the first recorded instance of which I know in the literature on nematodes in which the anus does not lie in the sagittal plane. I am of the opinion that the worm or worms studied were twisted in mounting or handling. Unless a series of sections of this worm can be shown in which the lateral lines are in the same plane with the anus, I can not accept MacCallum's conclusion. He says "that the vagina has not been seen, but appears to be very near the mouth on the left side." If it were not near the middle of the body and in the mid ventral line I would accept with some caution his conclusion, because this is the characteristic position of the vulvar opening in this genus.

MacCallum's *C. cyathocephalus* is clearly the fourth stage of his *C. scabræ*. I have described in detail this same stage for *C. americanus*.

Unfortunately the description of *C. bungari* is so incomplete and the drawing so obscure that it is impossible to locate the worm even with regard to its genus. Certainly with the slight description given it could not be placed in the genus *Camallanus*, because of the single portion of the esophagus and the type of the oral apparatus. The picture seems to show eggs in the terminal portion of the uterus; if the worm were mature, larvæ only would be found in this portion of the uterus if it belonged to the genus *Camallanus*.

Since I have found *C. americanus* in many different species of turtles in the United States, I have tried to decide whether or not MacCallum found this species and described it as one of his new species. In going over his paper carefully I am unable to admit that from his descriptions and figures he described the worm I recorded under the name *Camallanus americanus*, although it is possible that he might have had the worm. One can not be certain whether or not he had some of the species described by Leidy, nor can one be certain of the validity of any species which he describes.

In the face of these facts it seems to me that at present it would be impossible to accept these species in the genus *Camallanus* and hence I suggest that they be considered as *species inquirendæ*. *Camallanus* is such an important genus that the species described within it should be established without any doubt whatsoever. It is unfortunate that MacCallum did not publish more definite data concerning the forms and it is to be hoped that he will follow up his paper with a complete description of each worm, based on the study of more material and histologic sections.

In the past, nematode descriptions have for the most part been rather superficial and a great deal of confusion has arisen concerning the identification of genera and species. The worms are so difficult to study on account of the problem of proper technic that it is not surprising that many incomplete descriptions should have been published. It is to be hoped, however, that the day will come when nematodes will be as thoroughly studied and described as other parasitic worms have been and that their classification and identification will be made more certain.

THOMAS BYRD MAGATH

MAYO CLINIC,
ROCHESTER, MINN.

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AN AMICRONUCLEATE RACE OF PARAMECIUM CAUDATUM

PROBABLY no representative of the Protozoa has received more attention in matters relating to life cycles, reproduction, heredity and cytology than has *Paramecium.* It should be of general interest, therefore, to record the occurrence of a race of *Paramecium caudatum* which appears to be entirely devoid of a micronucleus. The recent studies by Dawson (1) on an amicronucleate race or species of *Oxytricha* add interest to the present discovery.

In the fall of 1914 Doctor M. H. Jacobs of this Laboratory used, in certain heat experiments, some *Paramecium caudatum* derived from a culture which exhibited great viability. During the following January Hance (2), in examining some of the sur-